

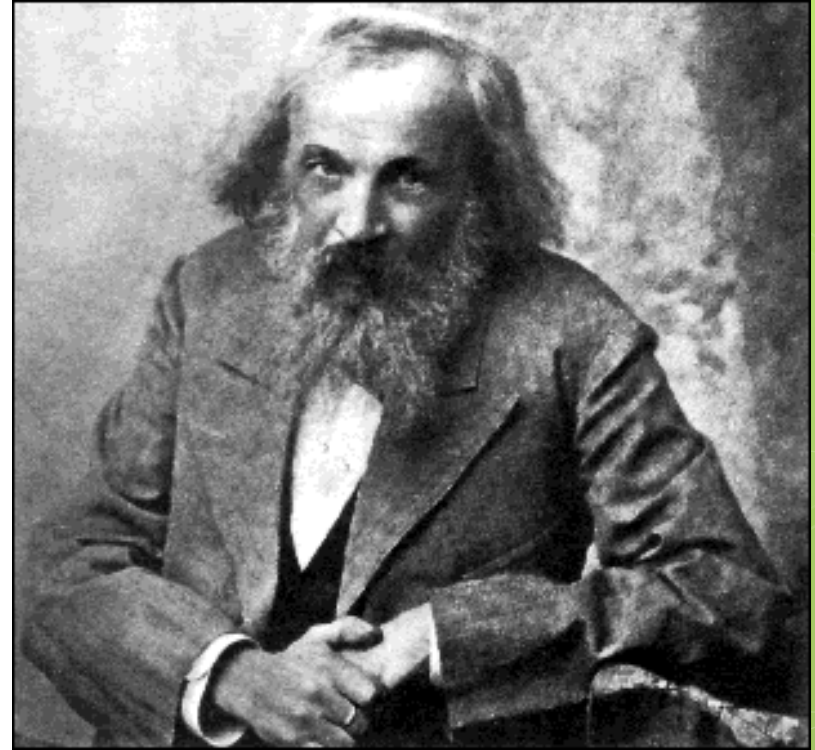
Organizing the Elements

Chapter 14

Organizing the Elements

Dimitri Mendeleev
(1834- 1907)

Developed the first
periodic table in the
late 1800s



Periodic Table

Mendeleev organized the elements by similarities in their properties

ОПЫТЪ СИСТЕМЫ ЭЛЕМЕНТОВЪ.

ОСНОВАННОЙ НА ИХЪ АТОМНОМЪ ВѢСѢ И ХИМИЧЕСКОМЪ СХОДСТВѢ.

			Ti = 50	Zr = 90	? = 180.		
			V = 51	Nb = 94	Ta = 182.		
			Cr = 52	Mo = 96	W = 186.		
			Mn = 55	Rh = 104,4	Pt = 197,4		
			Fe = 56	Ru = 104,4	Ir = 198.		
			Ni = Co = 59	Pd = 106,6	Os = 199.		
			Cu = 63,4	Ag = 108	Hg = 200.		
H = 1			Be = 9,4	Mg = 24	Zn = 65,2	Cd = 112	
			B = 11	Al = 27,4	? = 68	Ur = 116	Au = 197?
			C = 12	Si = 28	? = 70	Sn = 118	
			N = 14	P = 31	As = 75	Sb = 122	Bi = 210?
			O = 16	S = 32	Se = 79,4	Te = 128?	
			F = 19	Cl = 35,4	Br = 80	I = 127	
Li = 7	Na = 23		K = 39	Rb = 85,4	Cs = 133	Tl = 204.	
			Ca = 40	Sr = 87,6	Ba = 137	Pb = 207.	
			? = 45	Ce = 92			
			?Er = 56	La = 94			
			?Yt = 60	Di = 95			
			?In = 75,6	Th = 118?			

Д. Менделѣевъ

Mendeleev's Periodic Table

- Arranged in order of increasing atomic mass
- Arranged so that elements with similar properties were next to each other
- Left blank spaces in which undiscovered elements should be

Mendeleev's Periodic Table

- Mendeleev's work gave rise to the periodic table of elements
- An arrangement of the elements according to similarities in their properties

Periodic Table

Henry Moseley (1887-1915)

- British chemist who published a revised table in 1913
- Studied with Ernest Rutherford



Moseley's Periodic Table

- He measured the atomic number of atoms
- He showed that the properties of elements was based on the number of protons in the nucleus
- He rearranged the Periodic Table by placing the elements in order of increasing atomic number

The Modern Periodic Table

Periodic Law:

When the elements are arranged in order of increasing atomic number, there is a periodic repetition of their physical and chemical properties.

The Modern Periodic Table

Periodic table of the elements

period	group											13	14	15	16	17	18	
	1*											IIIa	IVa	Va	VIa	VIIa	0	
	Ia**																	
1	H																He	
2	Li	Be											B	C	N	O	F	Ne
3	Na	Mg	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
			IIIb	IVb	Vb	VIb	VIIb	VIIIb		IXb	Xb	IIb	Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
7	Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	112 *** (Uub)	113 *** (Uut)	114 *** (Uuq)	115 *** (Uup)	116 *** (Uuh)		
lanthanide series			6	58	59	60	61	62	63	64	65	66	67	68	69	70	71	
				Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
actinide series			7	90	91	92	93	94	95	96	97	98	99	100	101	102	103	
				Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	

* Numbering system adopted by the International Union of Pure and Applied Chemistry (IUPAC).

** Numbering system widely used, especially in the U.S., from the mid-20th century.

*** Discoveries of elements 112–116 are claimed but not confirmed. Element names and symbols in parentheses are temporarily assigned by IUPAC.

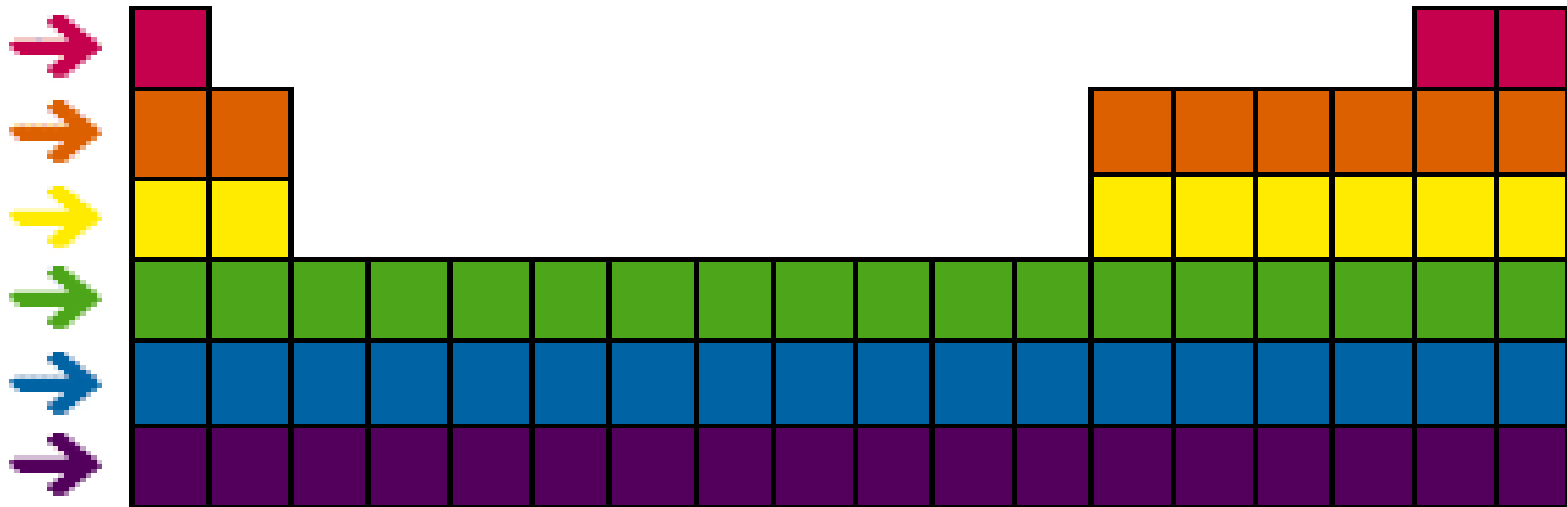
The Modern Periodic Table

Periods:

- The horizontal rows of the table:
 - There are 7 periods
- Properties change as you move across a period
- Properties repeat with each new period

The Modern Periodic Table

PERIODS



- The elements range from atomic number 1 to 118

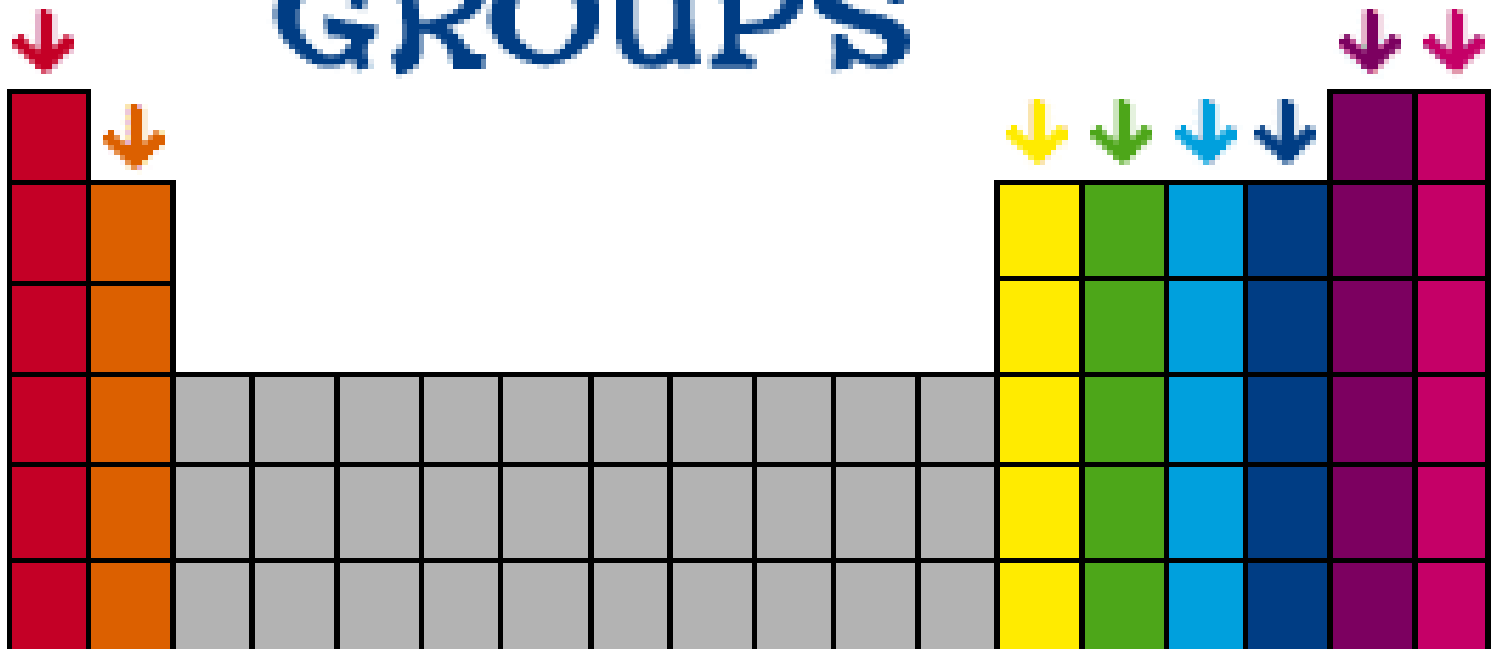
The Modern Periodic Table

Groups:

- The vertical columns on the table (also called families)
- The elements in a group have similar physical and chemical properties
- Each group has a letter and a number

The Modern Periodic Table

GROUPS



- Group A representative elements
- Group B transition elements

The Modern Periodic Table

Representative elements are divided into three groups:

1. Metals
2. Nonmetals
3. Metalloids

Metals

- Have high electrical conductivity
- Have high luster
- Are ductile - they can be drawn into wires
- They are malleable – can be formed into shapes

Metals

Types of metals:

- Alkali metals (Group 1A)
- Alkaline Earth metals (Group 2A)
- Transition metals
- Inner transition elements

Nonmetals

- Non-lustrous elements
- Most are brittle
- Generally poor conductors of electricity
- Located in the upper right-hand corner of the table

Nonmetals

Two Notable Groups

- Halogens: Group 7A
- Noble Gases: Group 0

Nonmetals

- Some are gases; oxygen and chlorine are examples
- Some are brittle solids; sulfur is an example

Metalloids

- Elements that border the line between metals and the nonmetals
- Elements with properties are intermediate between those of metals and nonmetals
- Examples: silicon and boron

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 *La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 +Ac	104 Rf	105 Ha	106 Sg	107 Ns	108 Hs	109 Mt	110 110	111 111	112 112	113 113					

58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

	Non-metals
	Metals
	Metalloids